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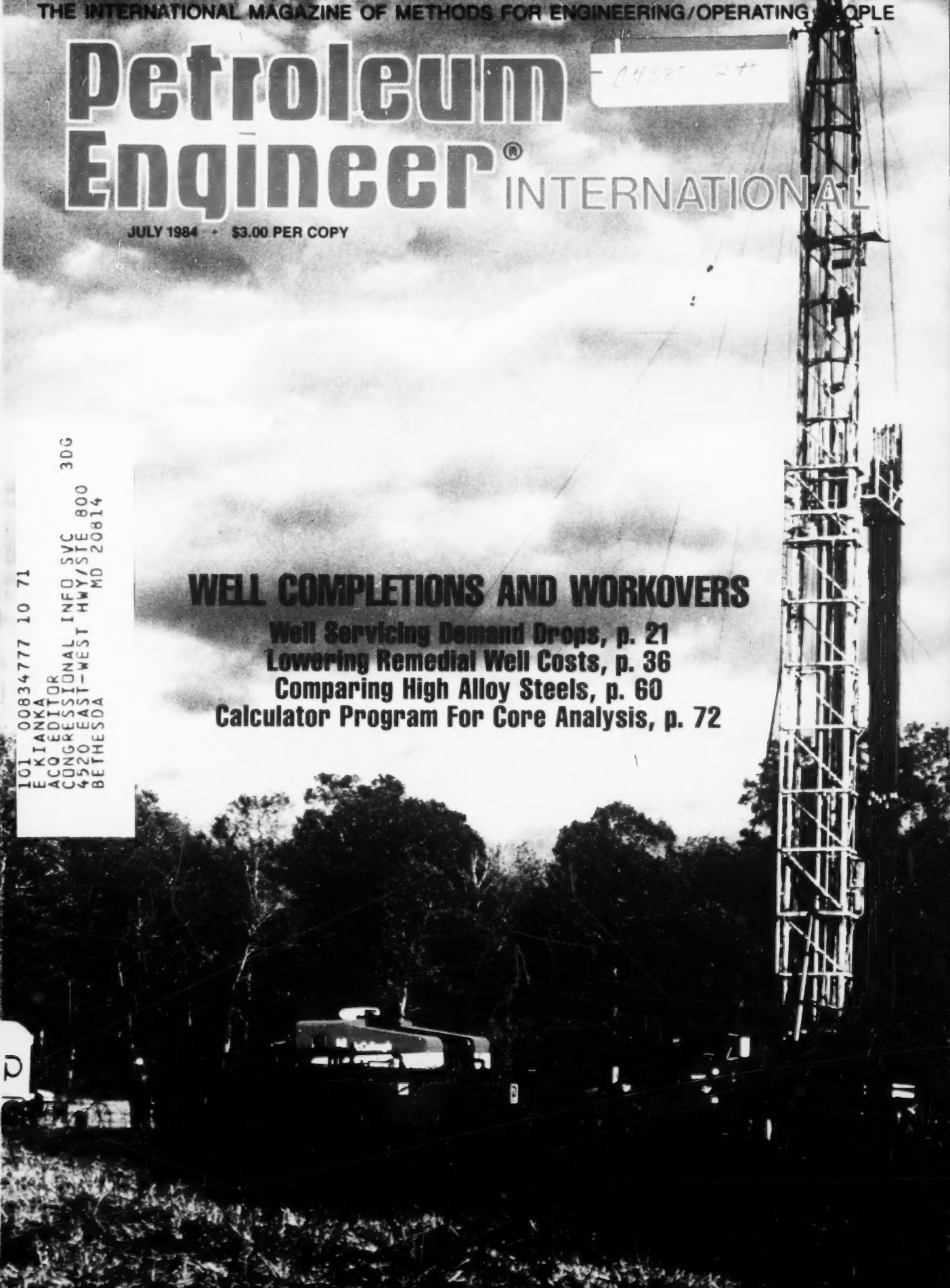

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Recovery Continues For U.S. Rotary Rig Count

U.S. drillers continued their spingtime recovery with nine straight weeks of increasing activity as of mid-June. That brought the average rig count for the year to 2,350, which is a far cry from the 2,700 rigs that were active at the beginning of 1984, but is better than the 2,119 average recorded for the first 24 weeks of 1983.

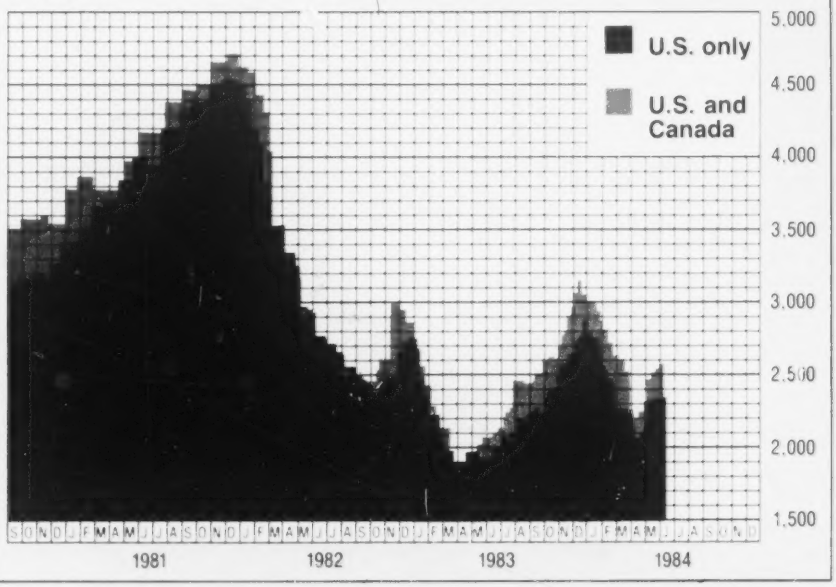
Texas continues to be the leader as far as rotary rig activity is concerned, with 855 rigs turning as of June 11. Oklahoma is second with 318. And Louisiana is a close third with 282. Other states in three figures include Kansas and Wyoming. California probably should be listed also, because the state was in three figures for 3 of the 4 weeks covered in this report.

U.S. offshore rig activity has been steady all year, with a little more than 200 rigs at work most of the time.

Rotary rigs actually making hole in United States & Canada

As Reported To International Association Of Drilling Contractors By Hughes Tool Co.

	May 21, 1984	May 29, 1984	June 4, 1984	June 11, 1984
Alabama				
Land	11	9	7	8
Inland Waters	2	2	2	2
Offshore	2	2	2	2
Alaska				
Land	9	8	9	9
Offshore	2	2	2	2
Total	11	10	11	11
Arkansas	21	25	25	25
Arizona	0	0	1	1
California				
Land	91	94	91	82
Offshore	16	15	16	14
Total	107	109	107	96
Colorado	42	50	39	44
Florida	2	3	3	3
Hawaii	1	1	1	1
Idaho	0	1	1	1
Illinois	48	52	52	53
Indiana	8	6	6	6
Kansas	132	129	130	132
Kentucky	8	9	9	12
North Louisiana	33	32	34	31
South Louisiana				
Inland Waters	48	49	46	51
Land	85	77	75	81
Offshore	118	111	114	119
Total	284	269	269	282
Michigan	30	33	28	31
Mississippi	32	31	34	27
Montana	26	25	28	28
Nebraska	10	10	11	11
Nevada	6	6	6	7
New Jersey	1	1	1	1
New Mexico	76	71	75	73
New York	8	10	13	10
North Dakota	50	55	53	52
Ohio	46	45	46	40
Oklahoma	320	325	317	318
Pennsylvania	27	28	30	36
South Carolina	1	1	0	1
South Dakota	1	1	1	1
Texas				
Offshore	64	62	67	71
Inland Waters	6	7	6	8
Dist. 1-S. Central Tex.	12	14	13	14
Dist. 2-Middle Tex. Coast	35	29	34	30
Dist. 3-Upper Tex. Coast	92	94	100	108
Dist. 4-Lower Tex. Coast	78	75	72	72
Dist. 5-Northeast Tex.	36	35	34	34
Dist. 6-Far Northeast Tex.	70	72	70	71
Dist. 7B-N. Central Tex.	54	52	54	53
Dist. 7C-W. Central Tex.	60	55	51	49
Dist. 8-Far West Tex.	139	144	154	151
Dist. 8A-West Tex.	60	66	70	74
Dist. 9-North Tex.	79	66	66	68
Dist. 10-Tex. Panhandle	52	53	50	52
Total	837	824	841	855
Utah	40	39	41	40
Virginia	3	3	3	3
West Virginia	39	39	37	43
Wyoming	83	98	98	105
Total U.S.	2,315	2,322	2,328	2,361
Canada	153	168	190	206
Canada-Offshore	13	13	14	14
U.S. and Canada	2,481	2,503	2,532	2,581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WELL COMPLETIONS AND WORKOVERS

Well Servicing Activity Drops From Previous Highs 21

by Steven D. Moore, Drilling Editor. Servicing costs in 1983 totaled just under $2.8 billion. That is 30% less than in 1981, when well servicing expenditures reached the $4-billion mark. See well servicing map on page 32.

Shell Lowers Remedial Well Costs With Through-Tubing Plugback 36

by Steve G. Weeks, Shell Western E&P Inc. Do not overlook the merits of plugging back a well bore with excessive bottomhole temperature, using available proppants and capping with cement. It can be most effective, with minimum expense.

What's New In Well Servicing? 48

Among equipment and techniques outlined this month are a rod guide coupling that uses polyethylene wheels to roll vertically on the tubing, plus a coring technique that provides data close to actual reservoir levels.

How High-Alloy Tubulars React In Acidizing Environments 60

by Dr. J. D. Garber and Mohammad Kantour, University of Southwestern Louisiana. Laboratory investigations indicate that martensitic and duplex stainless steels could be economically attractive in the most severe well conditions.

HP-41CV Analyzes Porosity, Permeability Data 72

by M. K. Scribner and Roy Engineer, Cities Service Oil and Gas Corp. Porosity and permeability data must be classified into ranges before application of statistical methods for their reduction to average values.

Electrical Submersible Pump Teardown Inspection, Part 4 88

by James F. Lea, Amoco Production Co. and William J. Powers, TRW Reda. The welded lock plate is welded on all threaded connections by some manufacturers as a precaution against vibrations loosening threaded connections.

What's The Outlook For Oil Field Suppliers? 91

by Harrison T. Brundage, Gulf Coast Editor. Hard times remain, though the situation is improving, and the worst seems to be behind us. Surviving suppliers are lean and operating with minimum personnel and stores.

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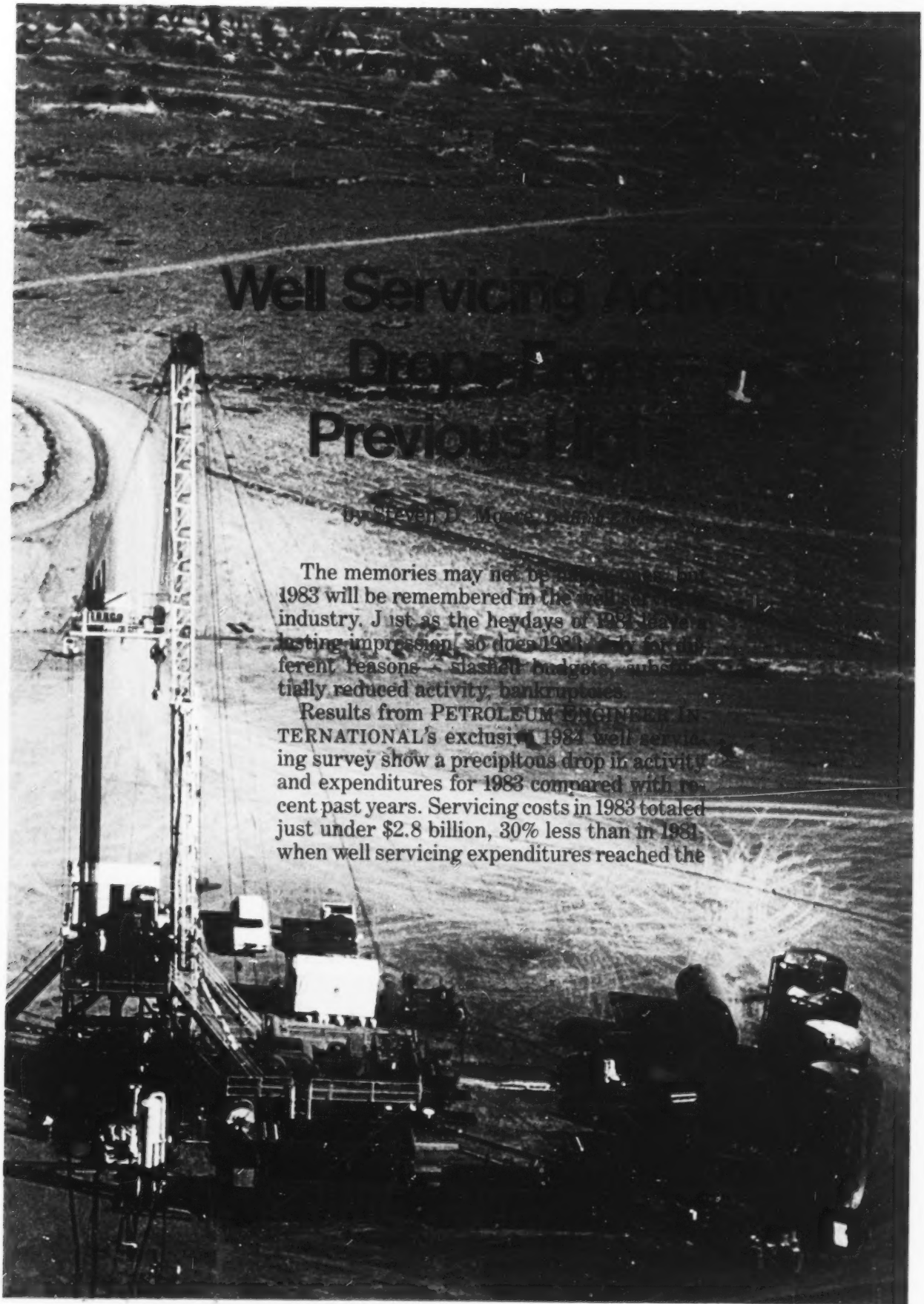
ABOUT THE COVER: The well servicing industry hopes for a recovery this year after 1983's slump. (Photo courtesy of Pool Co.)

NEXT MONTH: Technological achievements in European waters will be highlighted in the European Offshore Report in August.



Well Servicing Activity Drops From Previous Years

by Steven D. Mo[illegible]

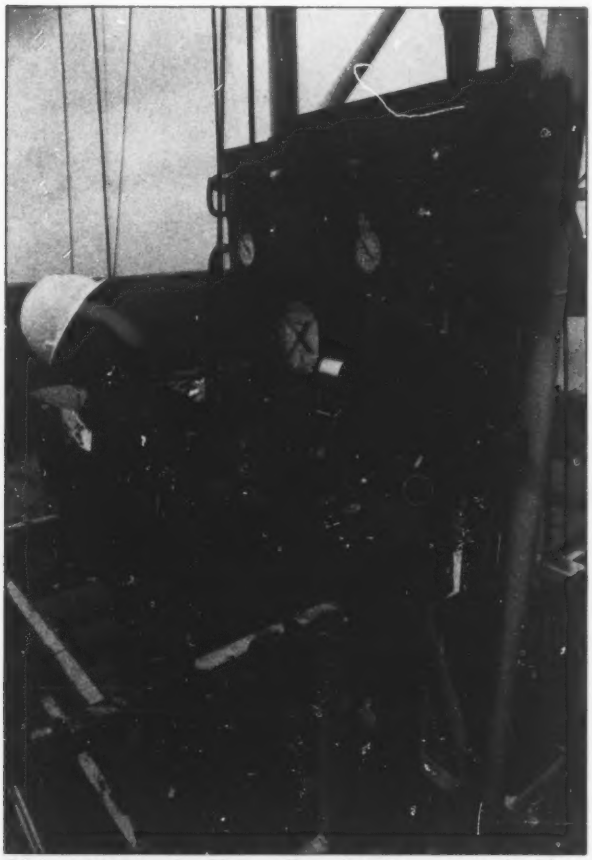
The memories may not be [illegible] 1983 will be remembered in the well servicing industry. Just as the heydays of 1981 leave a lasting impression, so does 1983—only for different reasons—slashed budgets, substantially reduced activity, bankruptcies.

Results from PETROLEUM ENGINEER INTERNATIONAL's exclusive 1984 well servicing survey show a precipitous drop in activity and expenditures for 1983 compared with recent past years. Servicing costs in 1983 totaled just under $2.8 billion, 30% less than in 1981, when well servicing expenditures reached the

$4-billion mark. The projected 1984 budget is slightly over $3 billion.

As a group, operators didn't come close to spending the $3.6 billion they estimated they would spend when completing last year's survey. In fact, the $2.8 billion spent last year was the lowest amount since 1978 and the first time expenditures fell below $3 billion since 1980.

The downturn in spending is even more disheartening because 90,000 wells were added to the U.S. well population in the last 2 years.



Of the 869,872 active U.S. wells, only 31% were serviced last year, compared with 70% and 58% of the active wells in 1981 and 1982, respectively.

Lack of demand for well servicing was primarily to blame for reduced spending – recompletions, artificial lift repairs, tubular repairs, and remedial stimulations were all down. Only 31% of the 869,872 active wells last year were serviced or worked over, compared with 70% and 58% of the active wells in 1981 and 1982, respectively.

Comparing the amount of work done in 1981 and then 2 years later, in 1983, may be somewhat unfair, however. In 1981, money was readily available and easily spent. Operators committed to rejuvenating older and even abandoned wells, and many of these wells were outfitted with completely new equipment.

By 1983 the tables had turned. Oil prices had stagnated and the natural gas market was in disarray. Operators were forced to live with diminished cash flows, so a certain percentage of necessary well servicing was left undone. Also, many wells were in such good shape from total workovers during the preceding boom that well servicing was unwarranted, at least temporarily.

Thus, while 1981's well servicing activity set an unprecedented high, available work during 1983 was abnormally low. Just as the huge inventory of tubular goods has to be whittled down, the number of operable wells in good condition must be reduced before demand for well servicing will pick up significantly.

Another reason for reduced spending in 1983 was the competitive pricing structure – or lack of structure – created by the servicing contractors. With an expanded rig fleet, and expectations of 1981 activity levels through the coming decade, contractors soon found themselves with an inordinate oversupply of rigs. Wholesale price cutting quickly ensued.

As a result, operators enjoyed more well servicing per dollar than ever before. Operators quickly found that they didn't have to spend all the money allotted for well servicing to get the necessary work done. For the contractor, well servicing became a hard way of life.

PEI's annual well servicing survey is compiled from the responses of over 200 operating companies, both majors and independents. The survey monitors 1983 activity, as well as future budget estimates. As in the past, the survey is broken down into 11 different geographic areas. Tables 1 and 2 are tabulations of U.S. completion, workover, and servicing totals for 1983, followed by summaries of regional well servicing activity.

TABLE 1. Completion, workover, servicing summary, by region, 1983

Region	Total wells	Completion, recompletion	Total art. lift	Lift repair	New lift installation	Tubular repair	Frac acid stimulation	Total budget, $M
U.S.(1)	869,872	72,994	606,474	293,468	33,997	47,000	26,815	2,789,510
Appalachia	139,817	7,251	71,542	20,256	3,281	6,291	544	118,844
California onshore	51,161	3,262	47,481	30,647	2,132	2,854	1,968	177,450
California offshore	1,846	170	1,582	515	108	80	18	33,320
Four Corners	15,695	822	2,217	1,267	215	195	130	26,681
Great Lakes	90,792	9,614	64,678	18,611	4,389	6,536	924	101,687
Gulf of Mexico	10,143	1,025	2,743	793	386	640	277	322,170
Louisiana onshore	42,048	5,335	24,168	14,175	1,357	1,245	1,079	222,013
Mid-Continent(2)	204,367	17,013	160,565	81,729	8,524	8,959	8,380	580,402
Rocky-Williston	36,745	4,929	24,201	14,044	1,767	3,525	2,392	248,396
Southeast	4,980	477	3,392	3,350	134	565	169	30,079
Texas(3)	272,278	23,096	203,878	108,081	11,704	16,110	10,914	928,468

(1) Excludes Alaska (2) Includes Texas Panhandle (3) Includes southeast New Mexico, excludes Texas Panhandle

Spending Way Down

With the exception of a slight increase in spending for offshore California, well servicing expenditures were down in the 11 geographic regions. The biggest percentage drop was in the Rocky-Williston area, where spending reached only $248 million, a 38% decrease from the previous year. Average well servicing costs declined from $12,370 per well in 1983 to $6,760 per well last year.

Texas operators once again spent the most money for well servicing. The group needed $928 million to service their wells, compared with $1.147 billion and $1.228 billion in 1982 and 1981, respectively. Although operators paid $100 million less for well servicing than they estimated last year, well servicing for Texas continues to represent one-third of the total U.S. budget.

The typical Texas well required $3,400 in well servicing, down from an average of $4,351 per well in 1982. Estimates for 1984 expenditures total $1.021 billion, a 10% increase over 1983. During 1984 operators plan to spend an average of $3,750 per well for servicing, an increase over last year, but still below 1981 and 1982 levels.

Second to Texas in spending was the Mid-Continent area, where operators paid $580 million for well servicing. Estimates for the coming year show a rebound to $643 million. Servicing the typical Mid-Continent well ran about $3,150 last year, compared with $3,486 in 1982.

The most expensive region for servicing a well continues to be the Gulf of Mexico. Offshore operators required $322 million in well servicing for just 10,142 wells. Average servicing cost per well dropped to $32,000 last year, but was still ahead of the second most expensive region – offshore California – where servicing averaged $18,000 per well.

Decreased spending in the Gulf was due in part to lower rates for barges, workover rigs, and supply boats. Operators anticipate slightly higher spending this year. The long-term outlook appears even better, particularly if exploratory and development drilling continue at accelerated paces.

At the bottom end of the well servicing industry was the Appalachia region, where spending dipped to $850 per well, 64% less than in 1981. In the boom years of 1980 and 1981, shut-in and marginal Appalachia wells were commonly worked over and serviced. But in the last 2 years, the practice has become practically nonexistent. In addition, plenty of recently shut-in wells have good used equipment that can be employed as replacement equipment in wells requiring servicing.

Total U.S. well servicing expenditures for 1983 were $2.789 billion, with Texas and the Mid-Continent accounting for 54% of the spending. For the nation, the typical operator spent an average of $3,200 per well for well servicing last year, compared with $5,100 per well in 1981.

(Continued)

Maintenance has been nonexistent for many companies in the oil fields for the past 2 years; usable equipment is probably wearing out faster than most people expect.

TABLE 2. Completions and recompletions, by region

Region	Wells Jan. 1, 1984		Exploration		Development		Recompletions		Abandonments
	Oil	Gas	Oil	Gas	Oil	Gas	Same zone	New zone	
U.S.[1]	645,262	224,610	1,31	1,838	34,977	14,965	10,848	7,535	20,452
Appalachia	72,265	67,552	178	436	3,114	2,876	526	121	2,853
California onshore	49,981	1,180	60	29	2,175	51	623	324	1,582
California offshore	1,843	3	0	1	125	2	38	4	9
Four Corners	2,463	13,232	34	30	220	326	153	59	320
Great Lakes	65,331	25,461	234	123	4,213	3,504	1,024	516	2,121
Gulf of Mexico	5,715	4,428	4	36	264	227	299	195	117
Louisiana	28,102	13,946	14	19	1,533	752	1,329	1,6[illegible]	1,301
Mid-Continent[2]	167,255	37,112	427	193	8,918	2,408	2,014	2,153	3,112
Rocky-Williston	26,890	9,855	254	119	1,398	2,075	759	324	1,136
Southeast	3,811	1,169	26	27	142	94	75	113	207
Texas[3]	221,606	50,672	700	825	12,875	2,650	4,006	2,038	8,421

(1) Excludes Alaska. (2) Includes Texas Panhandle. (3) Includes southeast New Mexico; excludes Texas Panhandle.

Well Population Up

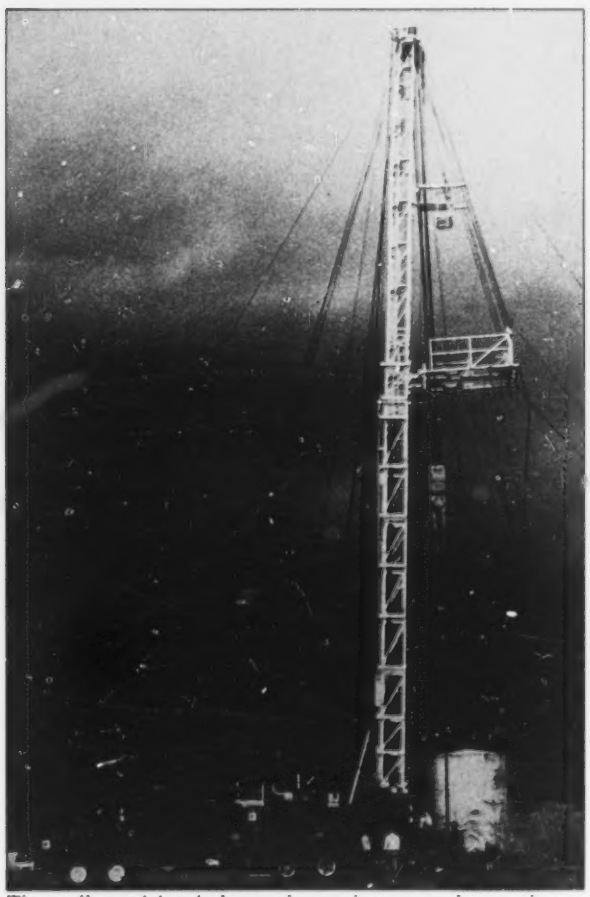
The number of well completions and recompletions has remained steady during the last 3 years. Operators completed 53,711 wells last year, down from 56,204 wells in 1982. Oil well completions slipped to 36,908 wells from 37,821 wells in 1982 – but well ahead of the 26,901 wells completed in 1980. Gas well completions also fell last year to 16,803 wells, down from 18,383 wells in 1982. The real downturn came in the number of recompletions. Recompletions dropped 19% from 22,632 wells in 1982 to 18,383 wells last year.

Meanwhile, the total U.S. well population grew for the ninth straight year. At year's end, 869,872 wells were capable of producing oil or gas, a 4% rise over the previous year.

Well abandonments jumped 80% over 1982 to 20,452 wells. The number seems more in line with historical trends, after several years of relatively few abandonments when marginal wells were not plugged and abandoned but serviced.

Total wells on artificial lift in 1983 reached another all-time high of 606,447 wells, 9% increase over 1982. In all, approximately 94% of U.S. oil wells are produced with some type of artificial lift.

Again, Texas led in completions and recompletions last year. Completed and recompleted wells in Texas totaled 23,096, about the same as 1982. Completions and recompletions in the Mid-Continent, the second most active area, dropped slightly last year, from 17,288 wells to 17,013 wells.



The well servicing industry has twice as much capacity as 5 years ago and a marketplace half the size it was in 1981.

Tubular repairs were down considerably last year. Only an estimated 47,000 jobs were performed in 1983, a substantial drop from 68,599 repairs in 1982. Tubing repairs outdistanced casing repairs 6 to 1. The number of tubular repairs in Texas stayed level with other years, but in the Mid-Continent and Great Lakes, tubular repairs were off by 50%.

Remedial acidizing and fracturing jobs also were off last year. Stimulation fell to below 27,000 jobs from 33,000 jobs in 1982. Stimulating gas wells has slowed considerably because of the natural gas bubble. Areas most active in stimulation were Texas, the Mid-Continent, the Rockies, and onshore California.

Competition among servicing companies was and is just as fierce as with the contractors. A large oversupply of trucks and equipment triggered price cutting as companies tried to maintain market share.

Rod Pumping

Conventional rod pumping continues to dominate the artificial lift market – more than 85% of oil wells on artificial lift use rod pumps. Last year, over 31,000 wells were equipped with rod pumps, about the same as in 1982 and 1981.

Even though demand for rod pumping equipment has remained steady, manufacturers of rod pumps, sucker rods, and pumping jacks are under pressure from their competitors. Overcapacity of manufacturing facilities plagues the market. Manufacturers, like servicing contractors, are discounting heavily to keep cash flow going. Lenient banks are floating insolvent manufacturers, just like drilling and servicing contractors.

Presently, 80% of sucker rods sold are for new installations; the other 20% go for repair and replacement. A catch-22 situation has developed in the sucker rod replacement market: many operators are replacing the entire sucker rod string during remedial work because sucker rods are so inexpensive.

Interestingly, complete sucker rod strings were installed in older wells during the boom years, too, but for a different reason. Well servicing and equipment costs were so high that operators couldn't afford to bring a well servicing rig to the well a second time.

Fiberglass sucker rods have found a small niche in the industry, but too many manufacturers vie for the limited market. Attempts to market aluminum sucker rods apparently have been unsuccessful.

Rod pump and sucker rod repairs were down from 1982 levels. Rod pump repairs fell from 207,000 in 1982 to 167,000 last year, and sucker rod jobs declined to 102,000 repairs or replacements from 130,000 jobs during 1982. Following historical trends, rod pump repairs ran well ahead of sucker rod replacements.

In 1981, 82% of rod pumping wells required some type of rod pump or sucker rod repair or replacement. By 1982, the percentage of rod pumping wells that required servicing dropped to 64%. Last year servicing demand fell even further to 50%. The rod pulling business should be improving slightly, but as long as oil prices remain stable, there won't be any great urgency to service wells.

(Continued)

	Total U.S.	Appalachia	California onshore
Abandoned (old wells)	20,452	2,853	1,582
Recompletions – same reservoir	10,848	526	623
Recompletions – different reservoir	7,535	121	324
Stimulation – acid or frac	26,815	544	1,988
Tubing repair or replacement	40,380	5,593	2,630
Casing repair	6,620	698	224
Rod pump repair	166,953	15,024	16,646
Sucker rod work	102,134	5,223	10,939
New rod pump installation	31,433	3,259	1,899
Submersible pump repair	8,471	—	435
New submersible pump installation	1,325	—	123
Hydraulic pump repair	10,413	—	2,283
New hydraulic pump installation	304	—	89
Gas lift repair	5,487	9	344
New gas lift installation	935	22	21

	California offshore	Four Corners	Great Lakes
Abandoned (old wells)	9	320	2,121
Recompletions – same reservoir	38	153	1,024
Recompletions – different reservoir	4	59	516
Stimulation – acid or frac	18	130	924
Tubing repair or replacement	56	172	5,619
Casing repair	24	23	917
Rod pump repair	—	727	12,413
Sucker rod work	—	477	6,076
New rod pump installation	—	200	4,381
Submersible pump repair	375	31	95
New submersible pump installation	91	4	6
Hydraulic pump repair	124	13	27
New hydraulic pump installation	5	1	2
Gas lift repair	16	19	—
New gas lift installation	12	10	—

Other Artificial Lifts

Demand for other types of artificial lifts – submersible pumps, hydraulic pumps, and gas lift – changed little during the past 2 years. Of the three, electric submersible pumps are the most popular choice.

In the coming decade, water cuts in average U.S. wells will increase dramatically – an operator will produce more water for every barrel of oil. Back in the '60s, 2 bbl of water typically were produced for every barrel of oil, but already in some areas – particularly onshore California – water cuts are as high as 20 to 1. In the future, more submersible pumps will be required.

Another positive trend in submersible pump usage is increased life expectancy – pumps are lasting longer between failures. The main reason is the advent of the variable speed drive, which reduces excessive wear at startup. Also, the quality of electric cables has improved significantly.

Hydraulic pumps are making a very small dent in the overall market, but the long-term outlook is good. The most likely candidates for hydraulic pumps are wells that are without access to electricity, have corrosive environments, or are fairly deep. Jet pumps seem more popular than reciprocating pumps because of lower maintenance costs, although operating costs are slightly higher.

Gas lift has found its niche in the market, as well. Typically operators will select gas lift if the field has a high GOR and no available means for marketing the gas. Obviously the Gulf of Mexico and Gulf Coast remain gas lift's strongest markets.

Outlook For 1984

The current well servicing situation is basically this: contractors, manufacturers, and servicing companies, all with twice as much capacity as 5 years ago, looking for work in a marketplace half the size it was in 1981.

For any significant improvement in utilization rates, either a stimulus for more work must develop – that is, higher oil and gas prices – or excess inventory must be worn down. Eventually the two lines will intersect again and the industry will return to profitability, but how long this will take is anyone's guess.

Most of the fly-by-night companies that entered the industry during the boom are long gone. Those who remain were around long before the boom and plan to hang on through the bad times. Even many of the companies emerging from bankruptcy proceedings plan to return to the industry. *(Continued)*

	Gulf of Mexico (offshore only)	Louisiana	Mid-Continent
Abandoned (old wells)	217	1,301	4,285
Recompletions – same reservoir	299	1,329	2,014
Recompletions – different reservoir	195	1,688	2,153
Stimulation – acid or frac	277	1,079	8,380
Tubing repair or replacement	352	965	7,519
Casing repair	288	280	1,440
Rod pump repair	—	7,630	46,831
Sucker rod work	—	4,496	31,778
New rod pump installation	—	1,070	8,127
Submersible pump repair	—	589	2,566
New submersible pump installation	—	97	362
Hydraulic pump repair	—	407	458
New hydraulic pump installation	—	22	18
Gas lift repair	793	1,053	96
New gas lift installation	386	168	17

	Rocky Mountains-Williston Basin	Southeast	Texas
Abandoned (old wells)	1,136	207	6,421
Recompletions – same reservoir	759	75	4,008
Recompletions – different reservoir	324	113	2,038
Stimulation – acid or frac	2,392	169	10,914
Tubing repair or replacement	3,189	490	13,795
Casing repair	336	75	2,315
Rod pump repair	6,781	949	59,952
Sucker rod work	3,516	644	38,985
New rod pump installation	1,373	93	11,031
Submersible pump repair	1,226	42	3,112
New submersible pump installation	266	21	355
Hydraulic pump repair	2,320	1,673	3,108
New hydraulic pump installation	93	20	54
Gas lift repair	201	42	2,924
New gas lift installation	35	—	264

Recently, several large financial institutions committed substantial sums of money to teetering contractors. Most contractors have half to two-thirds of their fleet financed – in other words, banks are into the well servicing industry as deep, if not deeper, than the contractors themselves.

Even though a contractor is mortgaged to the hilt and can't possibly cover his loan commitments, he has a willing partner with his bank. As long as the contractor can pay a little interest on his notes – so the bank doesn't have to claim the loan as nonperforming and thus set aside lendable reserves to cover it – the banks are willing to "let it ride". Basically, what's a bank going to do with all those rigs?

This banking strategy is not exclusively for contractors, but permeates every facet of the industry.

Ironically, the best hope for the industry at present appears to be the wearing down of inventory, including the rig fleet. Maintenance – the largest variable expense in any operation – has been nonexistent for many companies in the oil fields for the past 2 years. Usable equipment is probably wearing down faster than most people anticipate. While the Guiberson well servicing rig count shows the rig utilization rate hovering around 50%, chances are many of those idle rigs have deteriorated to the point where they are unsafe to operate, if they can be operated at all.

But the worst times for the well servicing industry are in the past. Activity already has rebounded and operators plan to spend more money for well servicing in the coming year.

Oil prices are creeping up, and the natural gas bubble is slowly dissolving. The natural gas situation is particularly encouraging for the well servicing industry, because few gas wells have been adequately maintained recently. Many operators may be surprised when they try to bring a well back on production and find it will take more than opening a valve.

As the industry rebounds, the biggest hurdle remaining may be psychological. There is more business out there than at any time during the 1970s. The industry has to get its hands dirty again and go get it. And the survivors will.

Acknowledgement. Data presented were based on PETROLEUM ENGINEER INTERNATIONAL's 1983 well servicing survey. Responses came from more than 200 independent and integrated companies. Appropriate data base used for projections was corroborated with data published by API. PEI also thanks Baker Oil Tools for helping to distribute surveys. Photos throughout the article are courtesy of Pool Co. ■

OVERSIZE FOLDOUT(S) FOUND HERE IN THE PRINTED EDITION OF THIS VOLUME ARE FOUND FOLLOWING THE LAST PAGE OF TEXT IN THIS MICROFICHE EDITION.

SEE FOLDOUT NO 1

Production Costs Decrease In 1983

The average cost of equipment for primary oil recovery operations in the U.S. decreased by 11.3% in 1983, compared with a 5.6% increase in 1982, according to the Department of Energy's Energy Information Administration.

EIA's latest report on Costs and Indexes for Domestic Oil and Gas Field Equipment and Production Operations reveals that decreases in costs from 1982 to 1983 varied with depths – ranging from 10.4% for 12,000-ft wells to 12.8% for 4,000-ft wells. These decreases are credited to large decreases in tubing costs, which, EIA says, also account for variation with depth, because higher grades of tubulars were not discounted as much as the lower grades. If tubing costs are excluded, equipping costs rose 2.9% in 1982 and fell by 3.3% for 1983.

In 1983, equipment (excluding tubing) costs for 12,000-ft wells went up by approximately 1%. Decreases (again excluding tubing costs) of 10.8%, 8.9%, and 3.8% for 2,000-, 4,000-, and 8,000-ft wells, respectively, were observed.

By areas, the EIA report finds that Oklahoma had the largest decrease in equipping costs (6.5%) and south Louisiana had the smallest (4.1%).

Overall operating costs for primary oil recovery operations in the U.S. are reported to have decreased by less than 1% during 1983, compared with an 11.5% increase in 1982. Average primary operating costs for the six areas covered by the EIA study decreased almost uniformly for the shallower depths, which had rod or gas lift installations. The 12,000-ft wells, or hydraulic lift installations, had an increase of less than 1%. Average primary operating cost for a 12,000-ft well was more than twice that for a 2,000-ft well.

Cost increases for primary operations had larger variations when aggregated at the area level. Oklahoma, for example, had an operating cost increase of 4%, and California had a decrease of 7.2%. When depth is also considered, primary operating cost increases varied even more. In California, leases with 4,000-ft wells had an 8.1% decrease in 1983, while 8,000-ft wells in Oklahoma had the largest cost increase (5%).

Costs for the component "Fuel, Power, and Water" increased for all primary production operations in all areas except California, where those costs decreased by approximately 12%. Wyoming had the largest increases in Fuel, Power, and Water costs (7% to 12%).

Summary of equipment costs and composite indexes for primary recovery operations (10 producing wells)

Area	1981	1982 Index (1976 = 100)	1983*	1983* Cost, $
		2,000-ft wells		
California	174.2	178.2	159.3	799,700
Oklahoma	166.1	169.2	145.3	508,300
South Louisiana	171.4	174.1	150.8	558,100
South Texas	167.7	170.9	145.9	518,600
West Texas	168.0	171.0	146.6	517,300
Wyoming	168.5	174.8	157.9	556,400
Average	169.6	173.4	151.5	576,400
		4,000-ft wells		
California	171.0	176.2	153.9	1,081,400
Oklahoma	167.8	171.4	141.9	714,100
South Louisiana	177.6	181.7	165.3	704,100
South Texas	168.0	172.7	152.4	663,900
West Texas	170.1	173.5	147.8	748,700
Wyoming	170.5	176.3	156.7	795,300
Average	170.7	175.2	152.8	784,600
		8,000-ft wells		
California	186.1	200.6	182.4	1,665,800
Oklahoma	181.3	193.9	179.5	1,315,100
South Louisiana	180.8	183.1	162.9	897,400
South Texas	169.5	172.6	147.5	832,800
West Texas	173.7	176.7	153.8	1,364,300
Wyoming	171.5	176.2	155.8	1,392,800
Average	177.3	184.5	164.4	1,244,700
		12,000-ft wells		
California	189.0	204.8	182.8	2,057,500
Oklahoma	194.5	213.2	190.7	1,852,400
South Louisiana	194.5	212.1	191.3	1,975,200
South Texas	195.3	213.4	189.8	1,925,900
West Texas	195.8	214.1	191.6	1,903,800
Wyoming	197.9	214.9	193.6	1,903,200
Average	194.4	211.9	189.8	1,936,300
Aggregate average	181.5	191.6	170.0	1,135,500

*Preliminary
Note: Reported average or aggregate average indexes are indexes of the average costs. They are not an average of the index values.

Annual operating costs for offshore production operations in the Gulf of Mexico decreased by 5.8% in 1983, following a 1.3% increase in 1982. Most of this decrease can be attributed to decreased costs for workovers and related services in 1983. The average operating costs for 12-slot platforms decreased by 5.8% in 1983, compared with a 5.6% decrease for 18-slot platforms. Averaging costs by water depth gives a 5.6% decrease for platforms in 100 ft and 300 ft of water, and a 5.4% decrease for platforms in 600 ft of water in 1983.

Gas Equipment

EIA's index for the aggregate cost of gas lease equipment for all depths and areas indicates a continuation of the moderation in equipping costs increases (13.6% in 1980, 9.5% in 1981, 3.8% in 1982, and a 7.9% decrease in 1983). The 1983 decrease brought costs down to a level lower than those of 1981.

The dominant factor in determining gas well equipment costs is the production capacity of the equipment. For 1982, the increases in equipment costs aggregated by production rate ranged from 2.3% for 5 MMcfd wells to 6.2% for 50 Mcfd wells. This was a reversal of the trend seen for the last few years and is probably a result of the slackening in demand for deep gas well equipment.

In 1983, the changes ranged from a 9.9% decrease for 1 MMcfd wells to a 3.5% decrease for 10 MMcfd wells.

Operating costs for gas leases aggregated for all depths, areas, and produc-

tion rates increased 16% and 6.5% in 1981 and 1982, respectively. They then decreased by 1.1% in 1983. Production string protection and labor-related costs caused most of the increases for gas wells in 1981 and 1982, but these costs changed little in 1983.

Summing the costs over all depths and production rates by area and calculating the percent changes tells EIA that South Texas had a decrease of 6.6%, while West Texas had the highest increase (0.8%). North and south Louisiana costs decreased less than 2%, and the Mid-Continent and Rocky Mountain areas had increases of less than 1%.

Copies of the complete report (DOE/EIA-0185[83]) are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

UT Developing Gulf Coast Data Base

A data base on Gulf Coast petroleum reservoirs is being developed by the University of Texas's Center for Energy Studies and the Department of Petroleum Engineering.

Expected to be more detailed than any other system publicly available, the system is being tested this summer and should be functioning by fall, according to Dr. Kamy Sepehrnoori, assistant professor of petroleum engineering and coordinator of the project.

Sepehrnoori said that the system is designed so that a researcher can sit down at a terminal, type in questions using key words, and receive a paper printout of the information requested.

A researcher could, for example, ask such questions as:

- What wells in X County, Texas, have had bottomhole pressures of more than 10,000 psia?
- What has been the history of production of X well?
- What have been the production rates of all wells treated with acid in the last 5 years in X County, Louisiana?

Initially, the well and reservoir data base will cover 400 wells, onshore and off, in Texas and Louisiana. Logging and header information for the wells already has been compiled, and the researchers are entering more data in about 40 new categories, including geology, geophysics, petrophysics, paleontology, production, well testing, well stimulation, abnormal pressure zones and blowouts, formation water analysis, and hydrocarbon analysis.

This year, the data base will be available only through terminals at the University of Texas at Austin. Remote access is possible later, Sepehrnoori said.

NAM Strikes Gas Offshore Netherlands

A significant gas discovery has been completed by Nederlandse Aardolie Maatschappij (NAM) in Block L13, some 31 miles northwest of Den Helder, Netherlands. The well tested gas at a combined rate of more than 90 MMcfd from zones at 11,500 and 10,800 ft.

NAM is operator of the block for a group that also includes Clam Petroleum Co., Aminoil Netherlands Petroleum Co., Oranje-Nassau Energie B.V., and DSM-Aardgas B.V. They used the jackup rig Neddrill 4 to drill the well.

Seagull Discovery Offshore Corpus

Seagull Energy E&P Inc. has a gas discovery in Mustang Island Block 915 in state waters offshore Corpus Christi, Tex.

Drilled to total depth of 9,842 ft, Seagull's wildcat tested 5,575 Mcfd of gas and 72 b/d of condensate through an 18/64-in. choke at flowing tubing pressure of 2,325 psi from one zone. From another zone, it tested 2,194 Mcfd of gas and 36 b/d of condensate through a 12/64-in. choke with 2,365 psi pressure.

Global Tests New Pool Discovery

Global Natural Resources Inc.'s Hilda Parr No. 4-A, a new pool discovery in Duval County, Texas, tested 2 MMcfd of gas and 188 b/d of condensate on a 12/64-in. choke with 2,826 psi flowing tubing pressure and no associated water.

The Basal Yegua sand was perforated at 7,462-69 ft and at 7,473-80 ft, establishing deeper production in the Orcones field area.

Hrubetz Wildcat In Powder River Basin

Hrubetz Oil Co.'s No. 1-16 Thorson wildcat was drilled to total depth of 7,200 ft and completed as a Minnelusa oil discovery with production from an interval at 6,970 to 7,011 ft.

Located in Crook County, Wyoming, the well tested 551 b/d of oil and 350 b/d of water.

Panarctic Tests Delineation Well

Panarctic Oils Ltd.'s Skate C-59 step-out well, located approximately 2 miles southeast of the Skate B-80 discovery well and 12 miles off the northeast coast of Lougheed Island, has been tested over two intervals.

A drillstem test in the King Christian formation, at 3,317-27 ft, tested up to 6.8 MMcfd of gas along with up to 172 b/d of oil and some formation water. Production testing of the interval at 3,258-80 ft tested up to 16.3 MMcfd of gas. A preliminary absolute open flow for the well in this zone is calculated to be 50.5 MMcfd. The well was drilled to total depth of 7,546 ft from an ice platform in 1,207 ft of water.

Phil R. Monticello (left), petroleum engineering manager for Texaco USA's Denver operating division, and C. A. Pate (center), district petroleum engineer for Texaco in Tulsa, deliver a $2,500 check from Texaco's Philanthropic Foundation Inc. to Dr. Billy Crynes, professor and head of Oklahoma State University's School of Chemical Engineering. The check is being given to support the petroleum engineering option at OSU.

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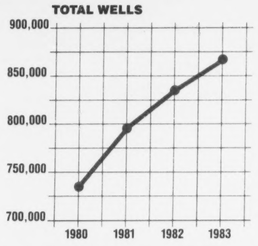
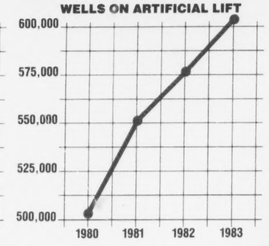
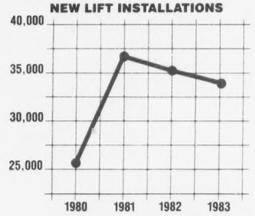
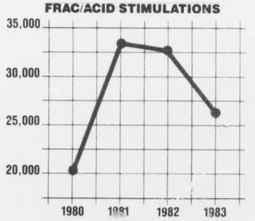
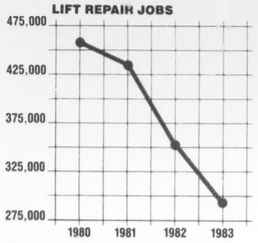
U.S. WELL SERVICING 1983

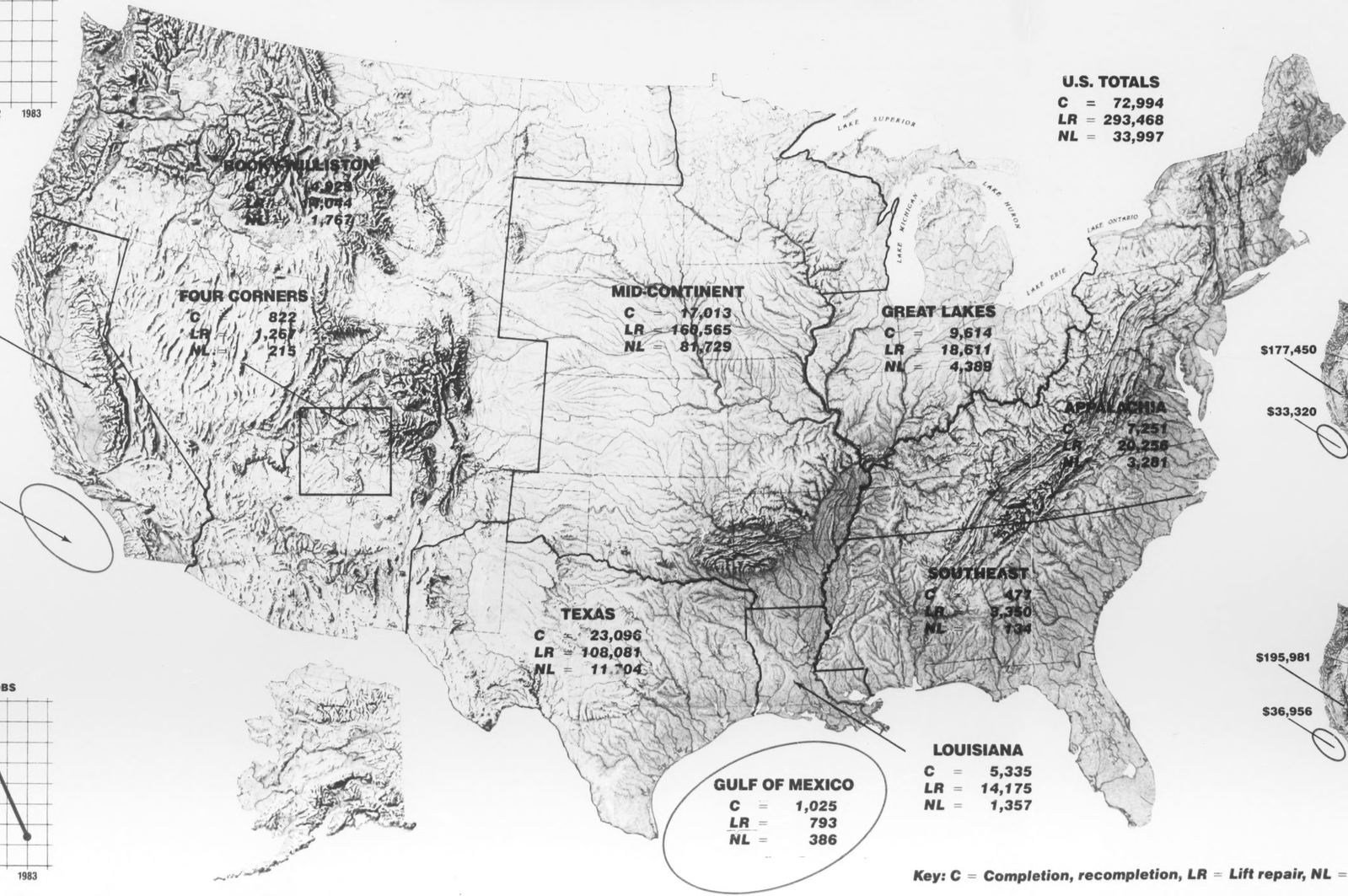








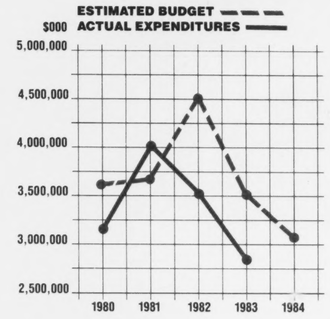




CALIFORNIA ONSHORE
C = 3,262
LR = 30,647
NL = 2,132

CALIFORNIA OFFSHORE
C = 170
LR = 515
NL = 108

U.S. TOTALS
C = 72,994
LR = 293,468
NL = 33,997



1983 WELL SERVICING EXPENDITURES
U.S. TOTAL = $2,789,510

ESTIMATED 1984 WELL SERVICING BUDGETS
U.S. TOTAL = $3,088,813

Key: C = Completion, recompletion, LR = Lift repair, NL = New lift installation